



SUSTAINABLE SUPPLY CHAIN AND OPERATIONS MANAGEMENT
ANNUAL SYMPOSIUM CONFERENCE
NOVEMBER 14, 2022



SUSTAINABILITY

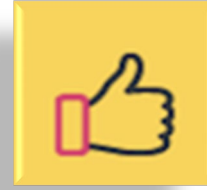
THE BUSINESS CASE FOR SUSTAINABILITY



Regulation
Legislation &
Compliance



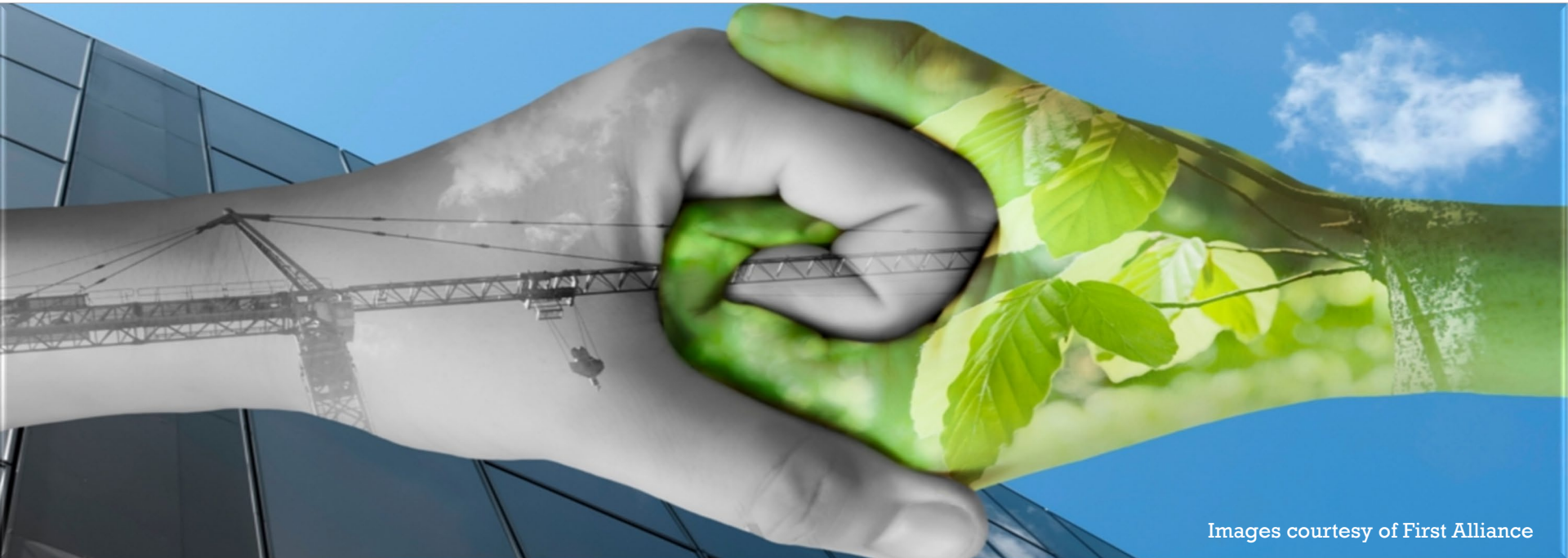
Risk
Short-term cost &
Long-term supply



Reputation
Brand loyalty,
sentiment & awareness



Profit
Cost reduction &
Competitive advantages



Images courtesy of First Alliance

GREEN SUSTAINABILITY

FOUR “R’S” OF GREEN SUSTAINABILITY

Sustainability Approaches	Description
Reuse	Reuse often requires disassembly, which is a systematic method of separating a product into constituent parts, components, subassemblies, or other component parts. The parts or components may be reassembled for reuse after cleaning, checking, and repair, or the individual components may be reused.
Remanufacturing	Remanufacturing essentially means that a product or part is returned to the market as “good as new.” Auto parts, tires, and electronics are frequently remanufactured.
Reconditioning	Reconditioning usually means returning used products to working order but not “as good as new.”
Recycling	Recycling generally refers to the secondary use of materials. It usually includes glass bottles, cans, newspapers, corrugated material, tires, etc. The recycling is usually performed for individual households by municipal government agencies

SSCM

Definition: The cooperative management of material, information, and capital flows among companies along the supply chain with a strategic focus on all three dimension of the triple bottom line (TBL), derived from an understanding of customer and stakeholder requirements and perceptions.

Social

- Living wage.
- Elimination of abusive and unfair labor practices.
- Community support.
- Healthcare.
- Supplier selection and monitoring.

Economic

- ROA.
- Efficient and effective.
- Continuing to be viable.
- Innovative.
- Strong SCM orientation.

Environmental

- Four "Rs".
- Reduced energy and materials.
- Supplier selection and monitoring.
- Reduction in waste and pollution.

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Green Supply Chain Management

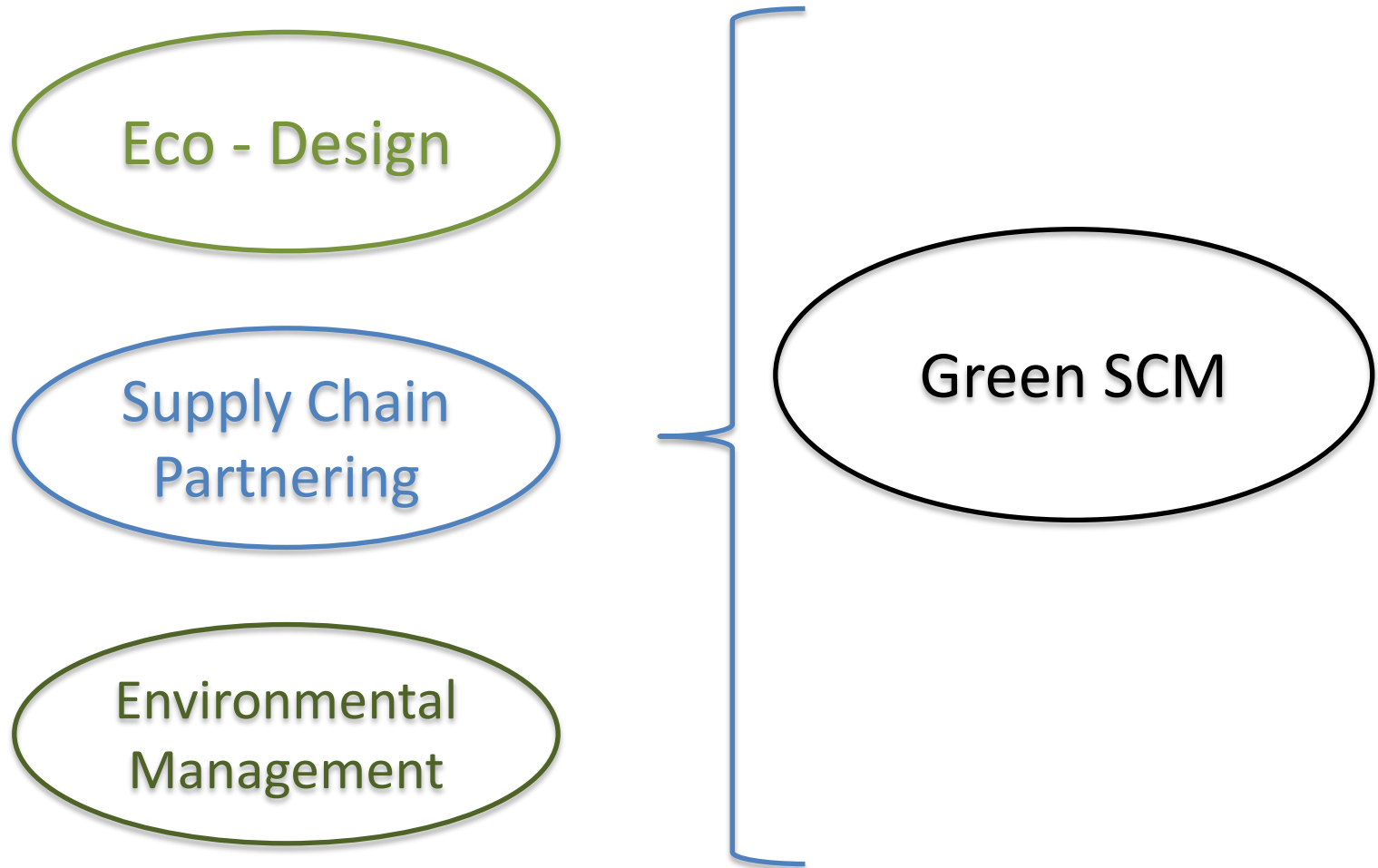
The integration of environmental and economic sustainability through the development of models and solutions which create a “dual focus: on the firm [...] and on the Earth system” (Whiteman et al., 2013, p. 329).

Seeking paths that lead firms to this dual focus, researchers have focused on **SCM because supply chain operations touch nearly every aspect of the firm** and thereby have a high potential to achieve environmental improvement

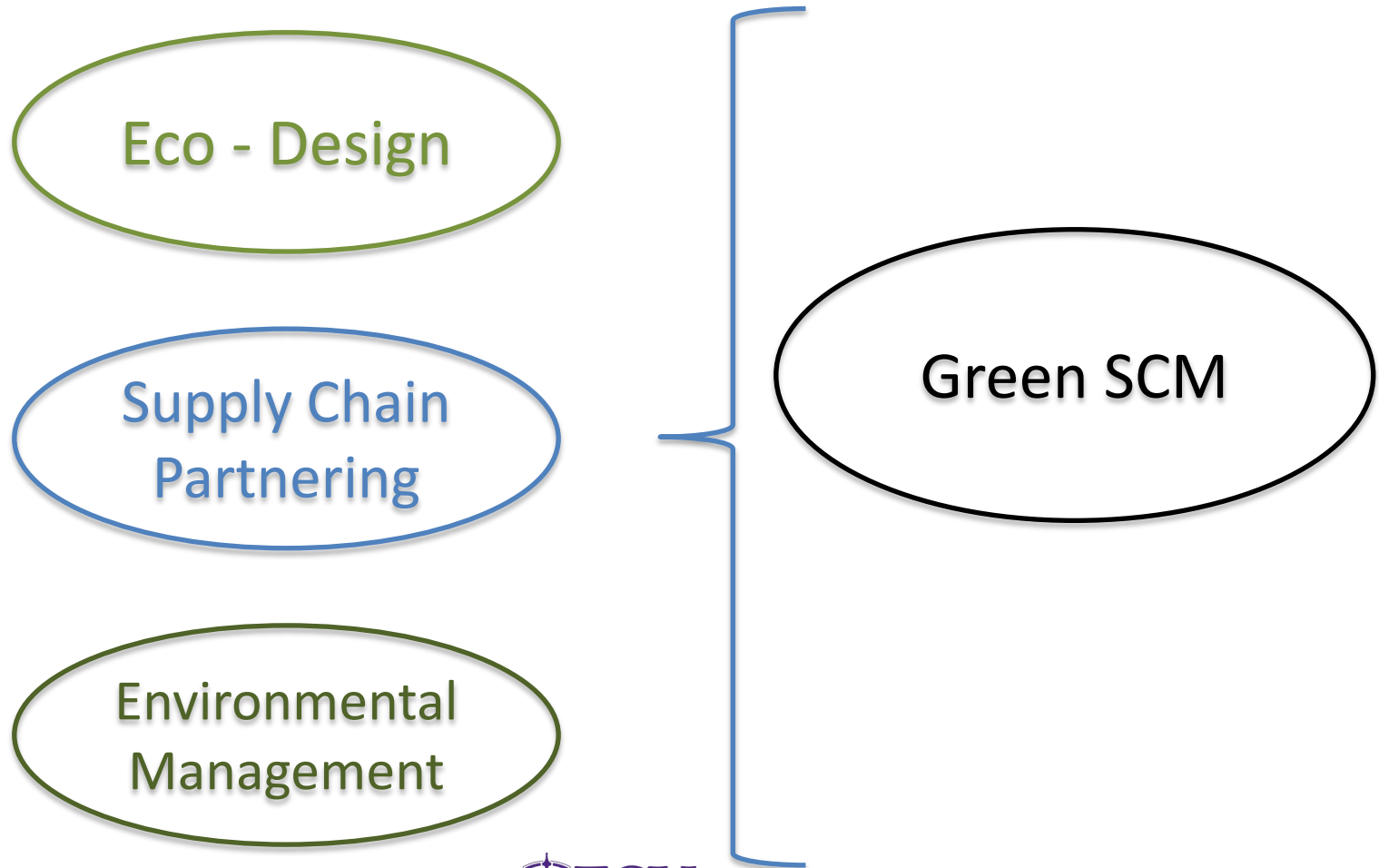
Green SCM is defined as the strategies, practices, and policies that concentrate on managing the environmental impact of supply chain operations. This definition includes an ecosystem philosophy:

1. decreasing externalities (waste and pollution).
2. materials recovery.
3. focusing on the economic benefits of environmental responsibility.

Green Supply Chain Management



Green Supply Chain Management



Green Supply Chain Management

Eco - Design

Eco-design is the design of products with environmental objectives and impact in mind; the practice involves cross-functional teams, supplier input and expertise, and technology in response to customer demands



Green Supply Chain Management

Eco - Design

Pollution Prevention

Design for less material, less energy, and process efficiencies.

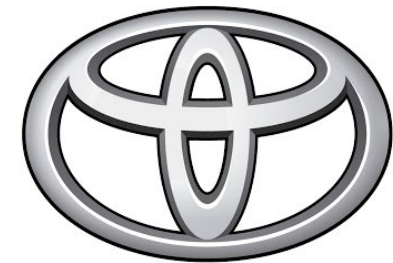
Design for material loops – 4 R's

Design for increased lifespan (serviceability, modularity, easy upgrades)

Reduction of hazardous material

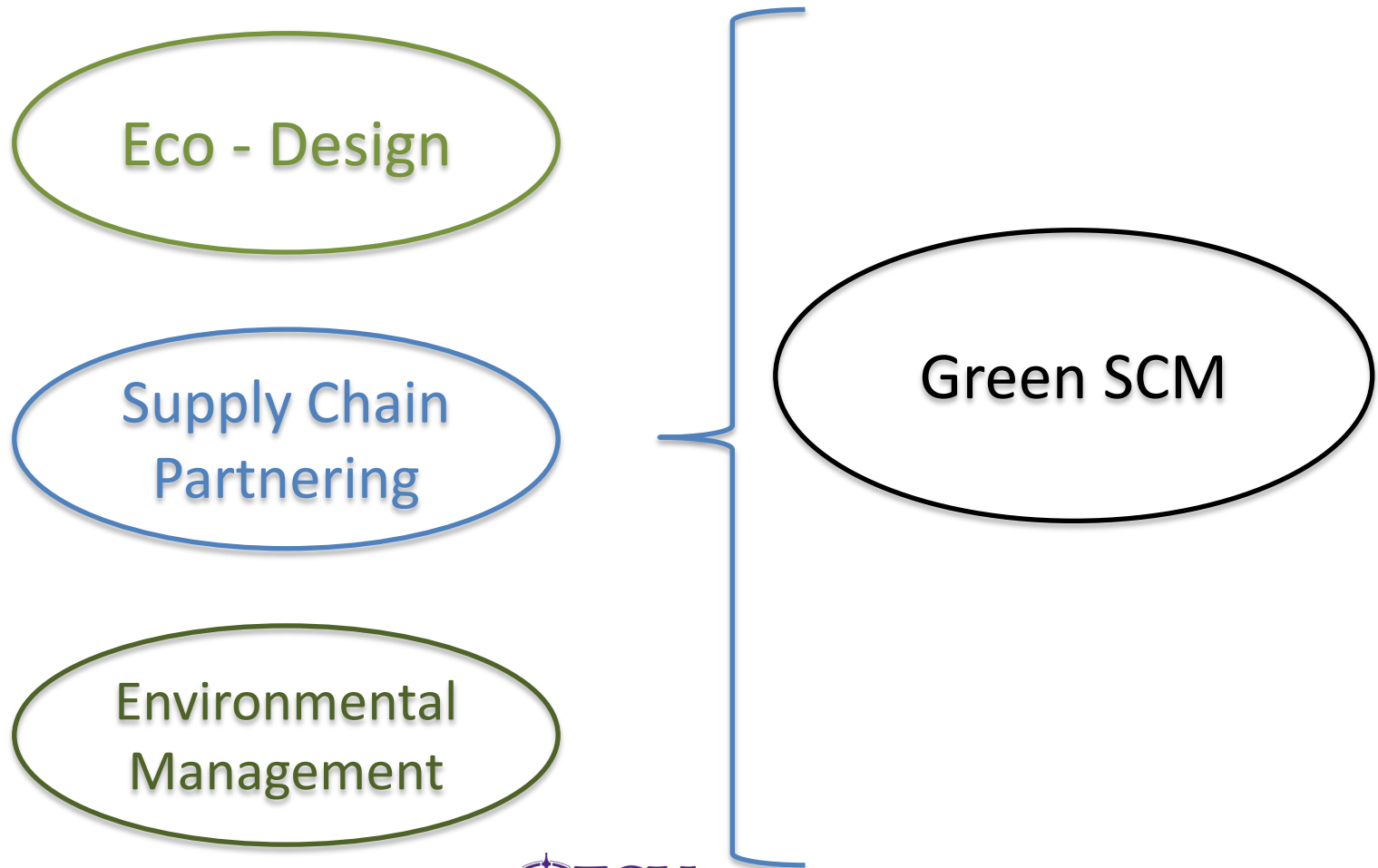
<https://www.youtube.com/watch?v=aS9Nc6-QY4U>

<https://www.youtube.com/watch?v=v0gDIQqwtTw>



TOYOTA

Green Supply Chain Management



Green Supply Chain Management

Supply Chain Partnering

<https://www.kodak.com/content/products-brochures/Company/Kodak-2017-Corporate-Responsibility-Report.pdf> Page 22

Supply chain partnering is the collaboration and cooperation with upstream and downstream members of the supply chain to set environmental objectives, resolve environmental issues, share green technologies, reduce environmental impact of products, processes, and packaging through product design and re-design, improve efficiencies throughout the supply chain, and improve customer satisfaction.



Boise Cascade Corporation



OfficeMax®



Green Supply Chain Management

Supply Chain
Partnering

https://www.youtube.com/watch?v=WDSb96gyraQ&feature=emb_imp_woyt

Supplier selection and ongoing evaluation

Buyer-supplier decision making to reduce environmental impact of products, processes, logistics, and packaging.

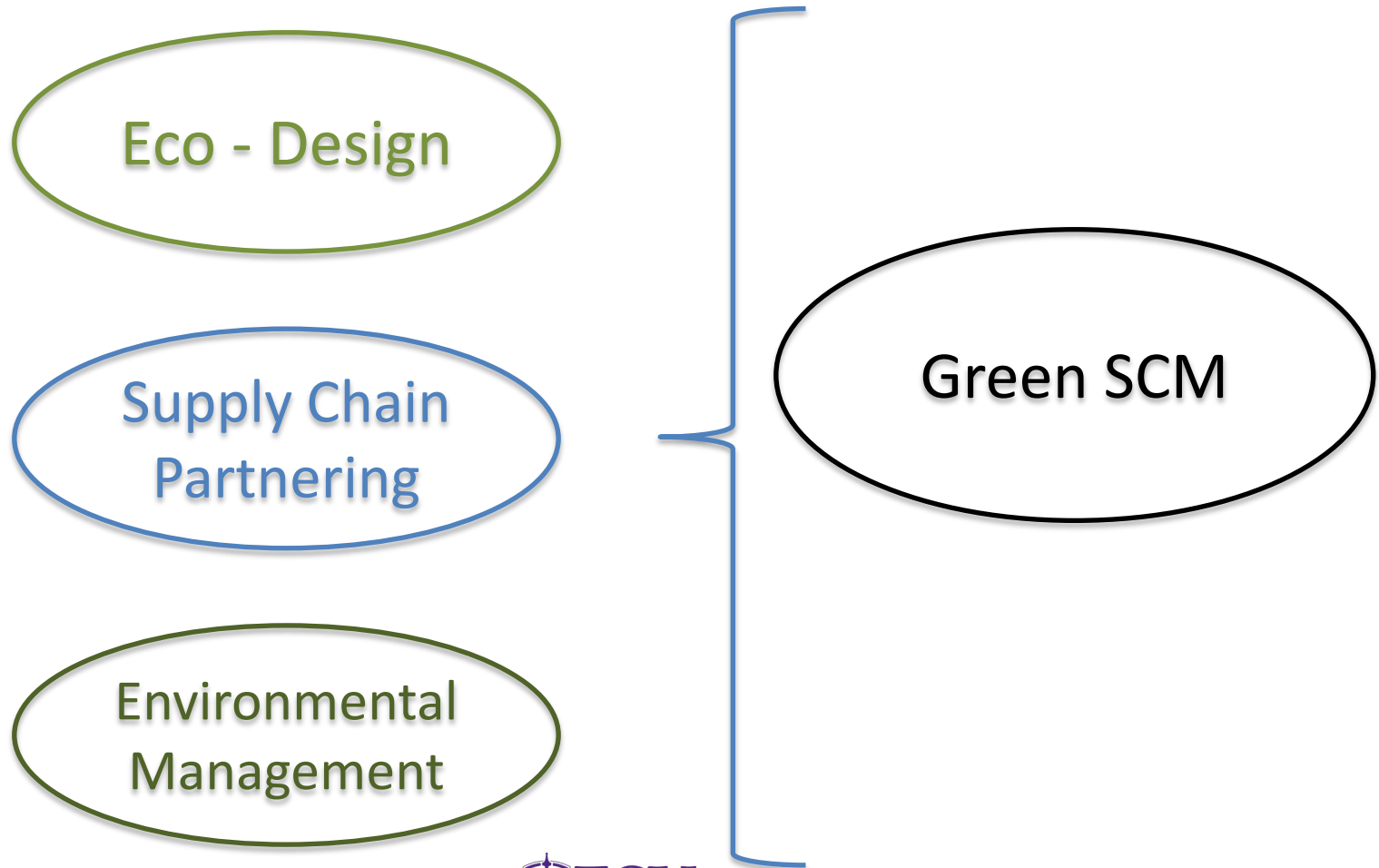
Cooperation with customers to reduce environmental impact of products, processes, logistics, and packaging.

Reverse logistics

The Campbell Soup Company has announced four new [sustainability](#) goals, including a pledge to make 100% of its product packaging recyclable or compostable by 2030 by building and investing in supply chain partnerships.



Green Supply Chain Management



Green Supply Chain Management

Environmental Management

<https://www.youtube.com/watch?v=U-mdnI9Pg4M>

Environmental management is the processes and procedures that support environmental objectives and initiatives *inside* the firm. This includes management support, cross-functional cooperation, and TQEM



“ We feel now is the time to invest - truly and authentically - in ways to help create a better future for the world we share. ”



Green Supply Chain Management

Environmental
Management

<https://youtu.be/DWLrmnAkBaU>

Environmental key performance indicators (KPIs)

Total quality environmental management (TQEM)

Management support

Employee engagement


Compliance internally/externally

ISO 14001 certification



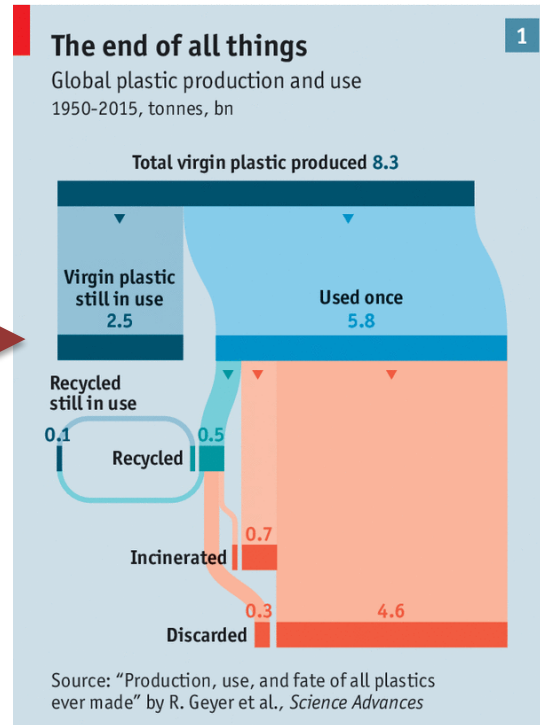
Issues with Sustainability

PUSHING THE ECO BUTTON



7 Vague Statements Companies Use to Greenwash Products

- SUSTAINABLE**
There is no consistent definition of what it means for a practice to be sustainable, and there are usually hidden tradeoffs.
- RECYCLABLE**
Many materials are technically recyclable, but are not practically recyclable. The question is not can it be recycled, but WILL it be recycled.
- BIODEGRADABLE**
This statement is not as meaningful as you think. Most materials are biodegradable! This does not mean they will not harm the environment, and it may take a very long time for them to actually break down.
- CRUELTY-FREE**
Cruelty-free also is not legally defined and anyone can claim it on a product label. Look for a legitimate certification logo such as the "Leaping Bunny".
- NONTOXIC**
Non-toxic is an unregulated term. It has no legal definition when used on a product label. "Green" and non-toxic household cleaners often contain potentially dangerous chemicals.
- ECO-FRIENDLY/ ENVIRONMENTALLY FRIENDLY**
Vague, and often meaningless unless explained in concrete terms. And, is the manufacturing process eco-friendly?



Economist.com

AT WHAT POINT IS A PRODUCT OR PROCESS SUSTAINABLE?

Challenges with Sustainability

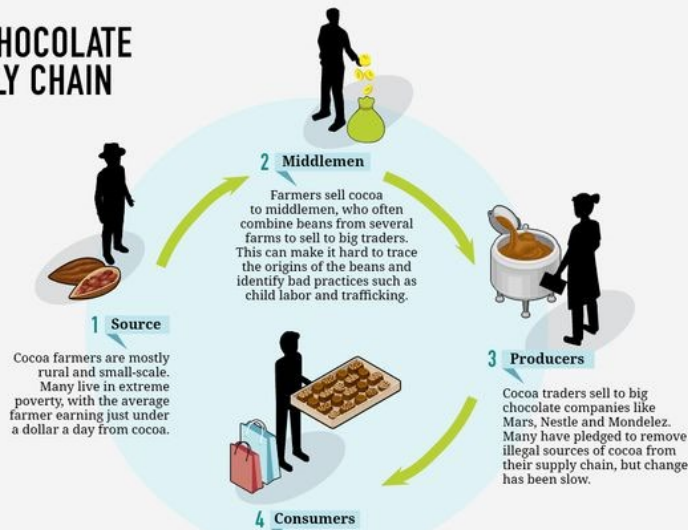


Challenges with Sustainability

DO COMPANIES KNOW IF THEY ARE BEING SUSTAINABLE?



THE CHOCOLATE SUPPLY CHAIN



Demand for chocolate among consumers is increasing, with Europe and North America the major markets.

Sources: BBC, fairtrade.org, Fortune Business Insights



Organic cotton VS Bamboo



Challenges with Sustainability

DO THEY
CARE?



Trade Offs in SSCM

1) MORE SUSTAINABLE VS. LESS SUSTAINABLE PRODUCTS AND PROCESSES

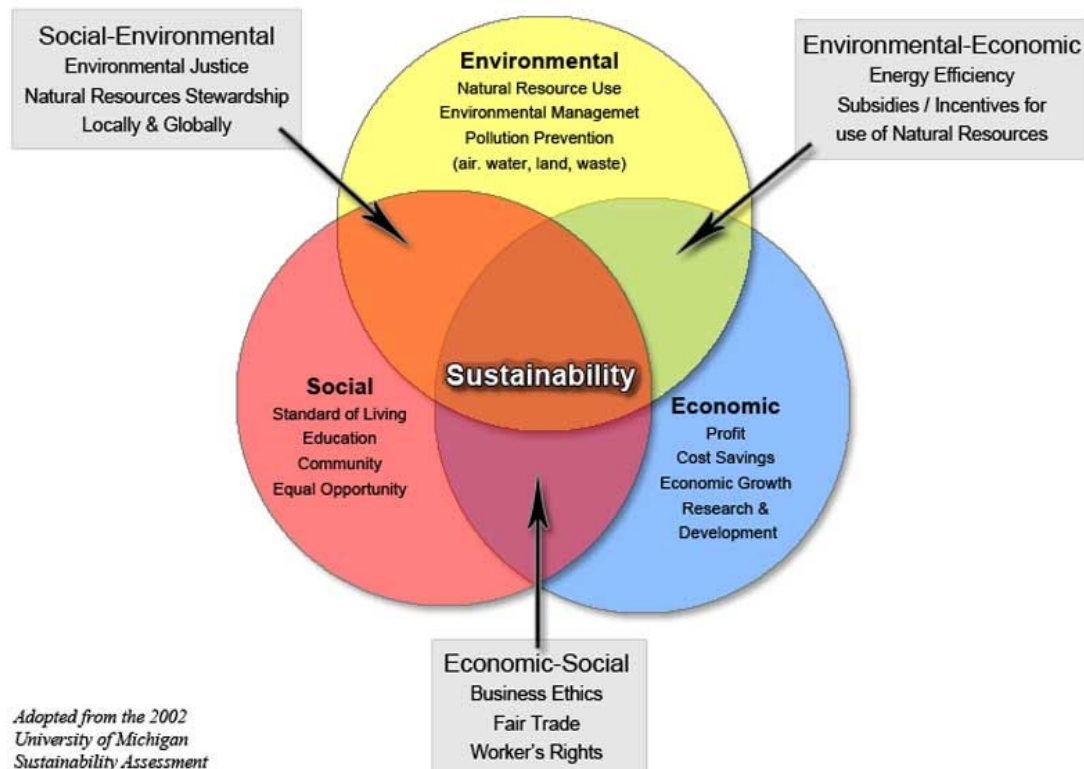


OR



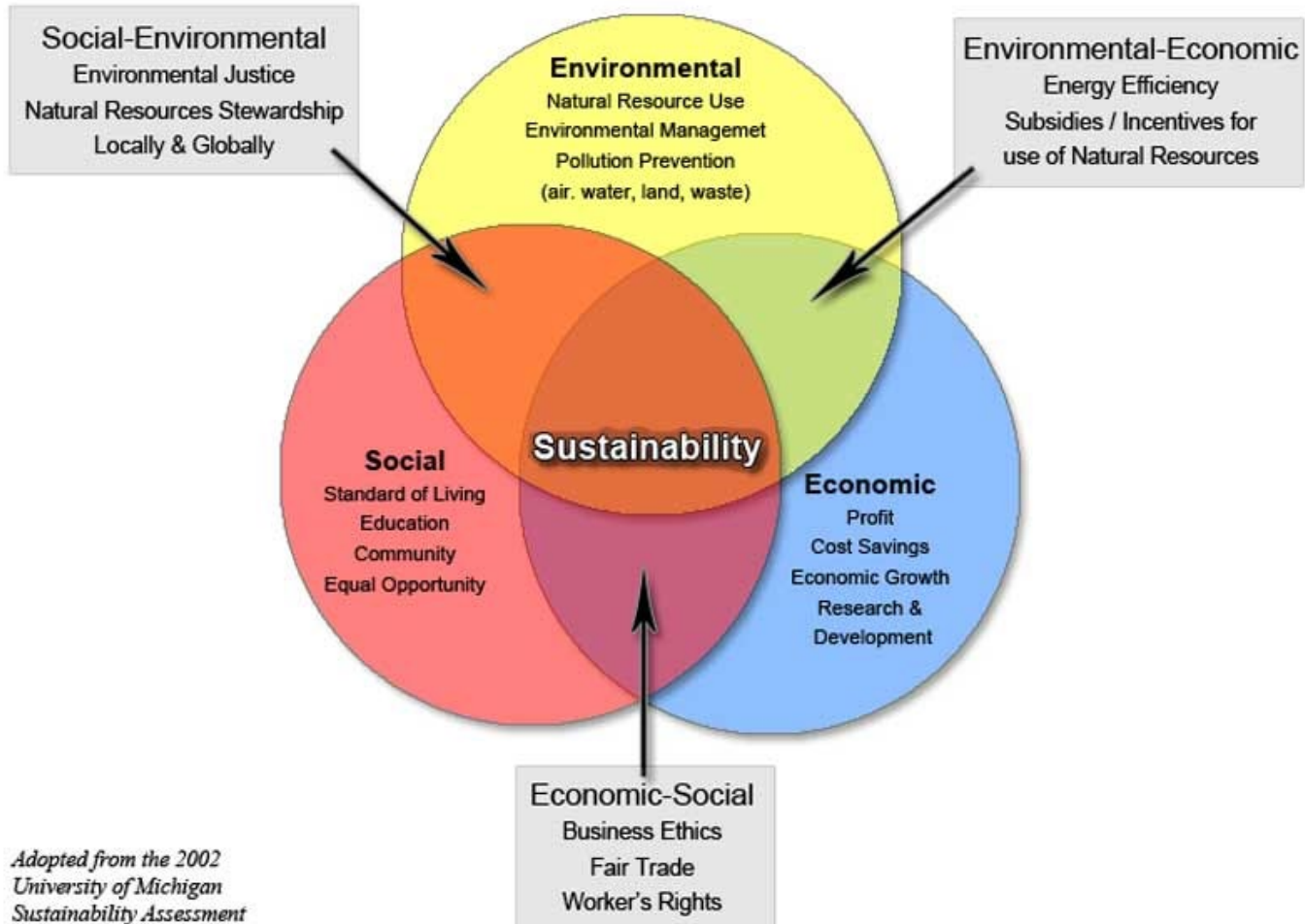
Trade Offs in SSCM

2) ONE DIMENSION OF SUSTAINABILITY VS. ANOTHER DIMENSION



*Adopted from the 2002
University of Michigan
Sustainability Assessment*

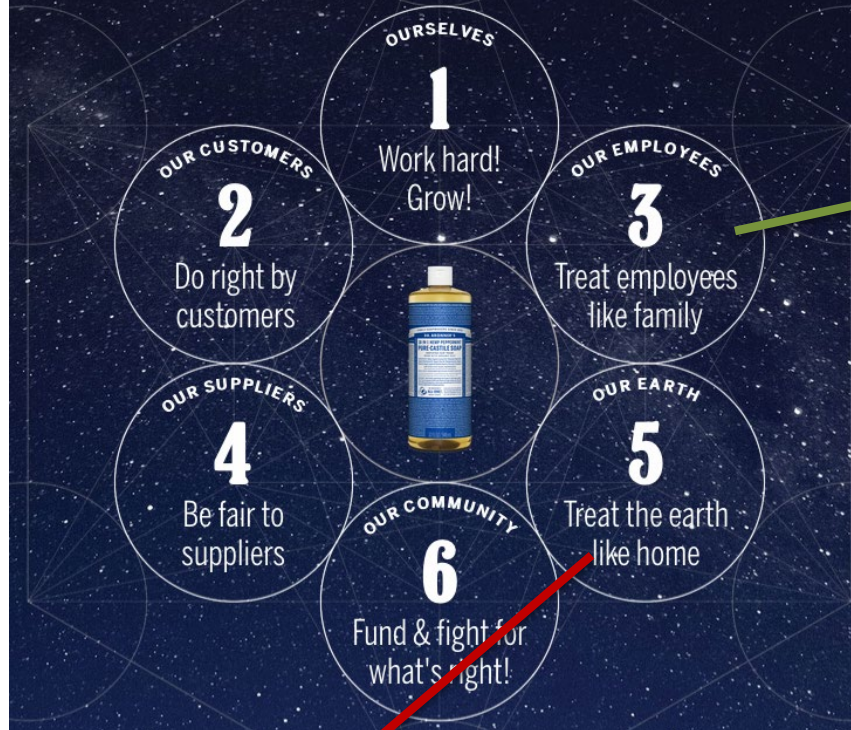
Trade Offs in SSCM



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Trade Offs: The Triple Bottom Line

Our Cosmic Principles define our most important relationships, and guide us in everything we do, from soapmaking to peacemaking – All-One!

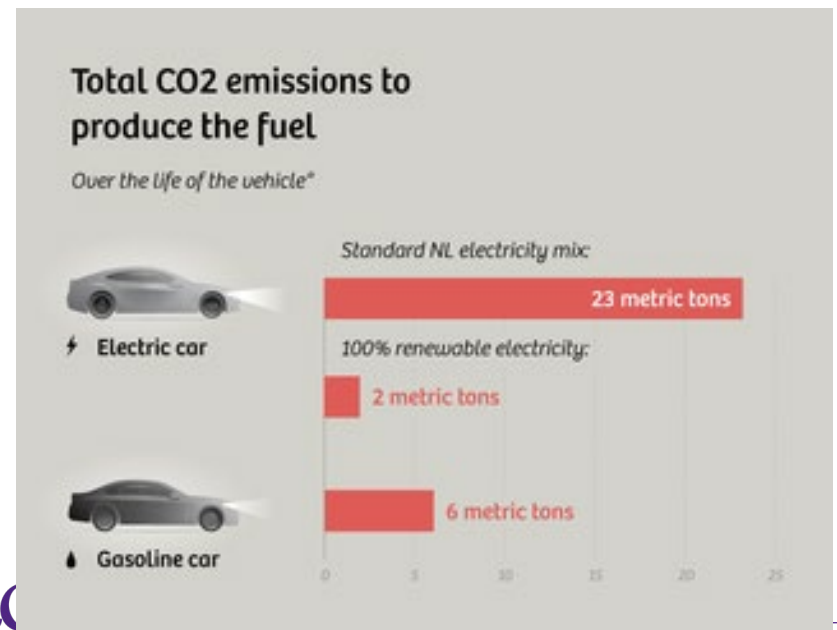


https://www.youtube.com/watch?v=_stYCuU5qBI

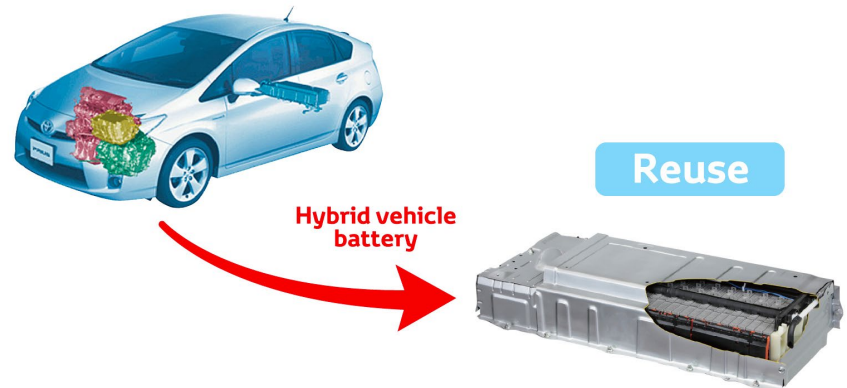
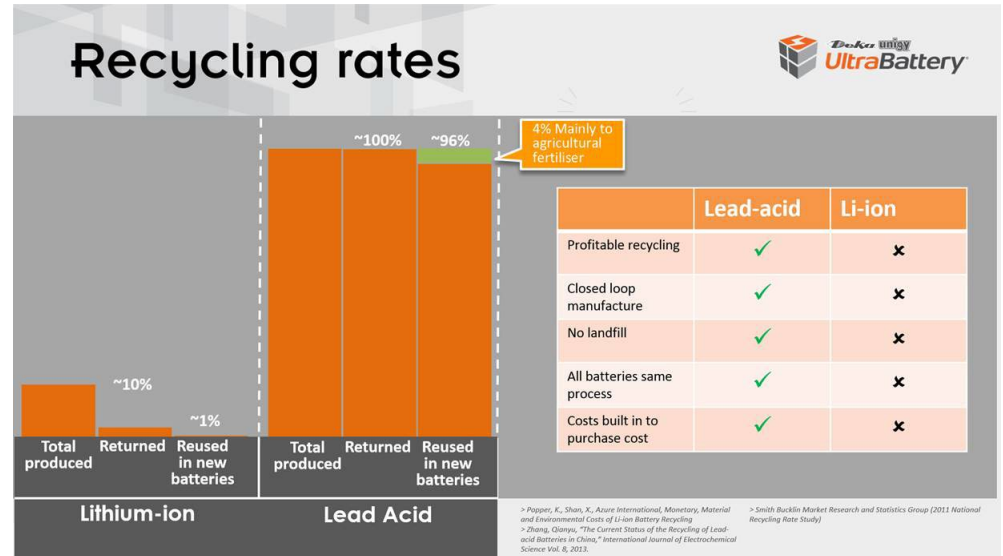
Trade Offs: Hybrid Cars

Vehicle Whole Life Carbon Emissions Analysis	Estimated lifecycle emissions (tonnes CO2e)	Proportion of emissions in production	Estimated emissions in production (tonnes CO2e)
Standard gasoline vehicle	24	23%	5.6
Hybrid vehicle	21	31%	6.5
Plug-in hybrid vehicle	19	35%	6.7
Battery electric vehicle	19	46%	8.8

*report prepared by Ricardo for in collaboration with the Low Carbon Vehicle Partnership that includes major vehicle manufacturers and oil companies



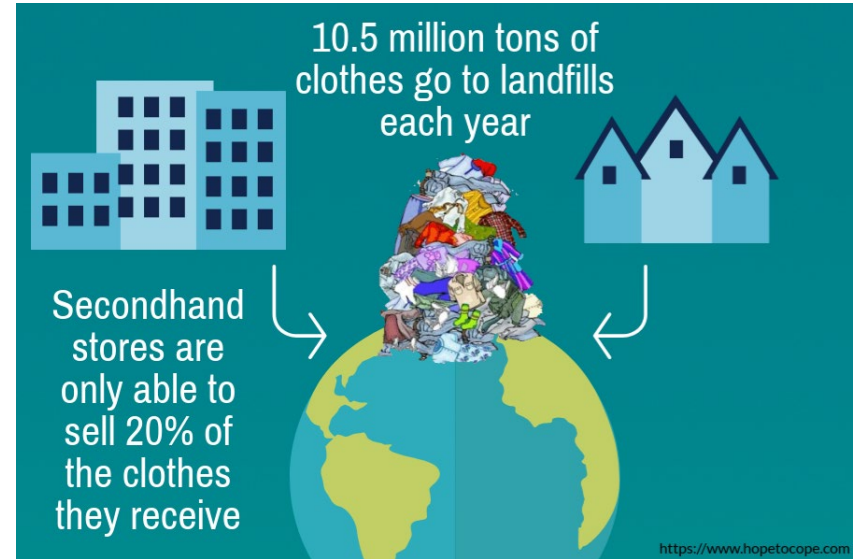
Trade Offs: Batteries



End-of-life hybrid vehicle

Hybrid vehicle battery collection

Trade Offs: Fashion



Article: The High Cost of Fast Fashion

Take a few minutes to read it....

THE REAL PRICE OF FAST FASHION

How fast fashion is changing the fashion landscape



100 billion clothing items are manufactured for 7 billion humans



Fast fashion items maybe discarded after being worn for **7-8 times**, creating huge amount of waste

Fast fashion companies grew by **9.7%** over 2010-2015



20% of produced clothes are not purchased and sent to landfill – H&M recorded **USD\$4.3 billion in unsold clothing** in 2018

From 4-season calendar earlier, fast fashion brings **52 micro-seasons of fashion**, leading to over-production of garments



Missguided launches **1,000 new products monthly**, while Fashion Nova launches **600-900 new styles weekly**

Environment and social cost of fast fashion

Environment impact



3,000 liter of water is needed to make one cotton shirt



8,000 liter of water is needed to make one pair of jeans



1.2 billion tonnes of CO2 emission annually



20% global wastewater production



\$400 billion worth clothes are discarded prematurely



21 billion tons of textile is sent to landfills annually



Discarded clothes of non-degradable fabric can remain in landfill for up to **200 years**



Double polyester (non-degradable) is used in clothing since 2000

Social impact



97% of fast fashion is made in developing countries with poor laws and human rights protection



Forced and child labor evidences found in Bangladesh, Brazil, China, India, Indonesia, Philippines, Turkey, Vietnam



Workers in developing countries such as Bangladesh earn only **\$2-3 per day**



Fashion Nova in Los Angeles paid workers **\$2.77 hourly**

In 2018, H&M was accused of **not providing fair wages** to factory workers – their wages were not sufficient to cover families basic needs



30% of substances used in textile manufacturing could pose threat to human life



60% of workers are children under age of 18 years



85% of textile factory workers are women, who work for long hours in toxic factory environment that could affect their health

Future Impact

2015

2050

Resource consumption¹

98 million tons

300 million tons

Textile industry's carbon budget share

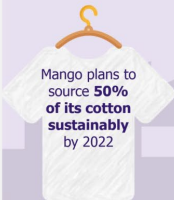
2%

26%

Microfibers in ocean

22 million ton added over 2015-2050

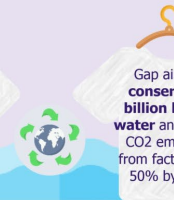
Sustainability measures taken by companies



Mango plans to source **50% of its cotton sustainably** by 2022



Zara aims to use **sustainable, organic, or recycled** material across all its clothing by 2025



Gap aims to **conserve 10 billion liter of water** and reduce CO2 emissions from factories by 50% by 2020



H&M's Conscious clothing line is made of **sustainable materials** and promotes recycling

Trade Offs: Fashion

1) Consumption of non-renewable resources, like oil to make synthetic fibers, fertilizers to grow cotton, and chemicals to produce dye and finish fibers

Technology and SSCM

TECHNOLOGICAL ADVANCEMENTS HELPING SSCM INNOVATE AND EXPAND:

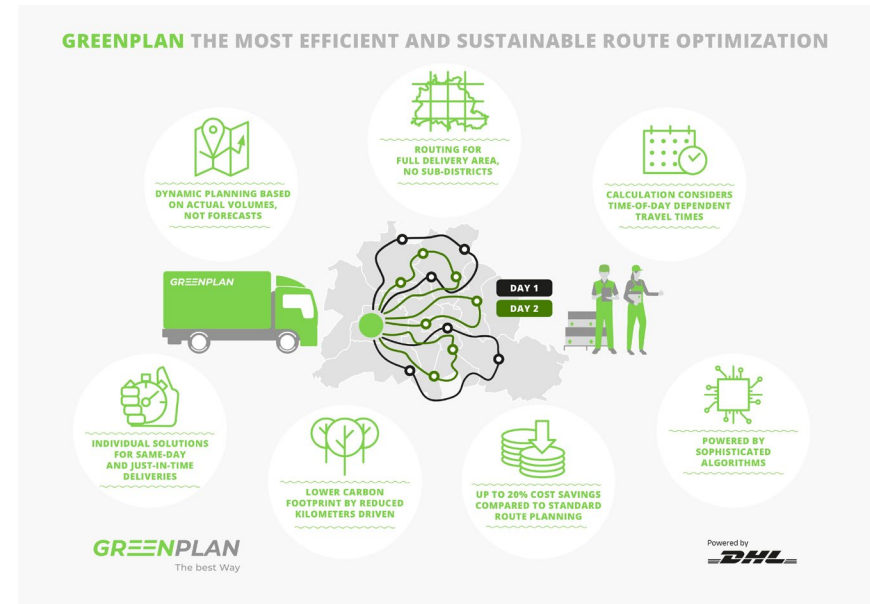
Tracking and optimization software

Internet of things (IoT)

Robotics

Artificial intelligence (AI)

Design and engineering tools



Blockchain technologies

SSCM Resources

Harvard Business Review: A More Sustainable Supply Chain

<https://hbr.org/2020/03/a-more-sustainable-supply-chain>

Sustainable Supply Chains at MIT

<https://sustainable.mit.edu/>

<https://sustainable.mit.edu/state-of-supply-chain-sustainability-report-2020/>